All questions are to be answered *on your own paper*. Related tables, charts, and diagrams can be completed on the [Data Sheet (PDF)](http://www2.sascurriculumpathways.com/ProductEntrance/InterActivities/science/biology/botany/Photosynthesis/index.jsp?Page=dataObservations) provided by your teacher.

Photosynthesis: Data & Observations

Part I: The Photosynthetic Process

1. Click the Observe tab to learn about the process of photosynthesis.

The thylakoids are a series of flattened membrane sacs found in the chloroplast. The first set of the photosynthetic reactions is found embedded in the thylakoid membranes.

The stroma is the fluid-filled cavity that takes all of the space inside the chloroplast not occupied by the thylakoids. The second set of the photosynthetic reactions occurs in the stroma. These reactions proceed in a cyclical fashion, with products of each reaction acting as reactants in the next. Ultimately, the series of reactions arrives back at the point where it started and then begins again.

1. Work through each section using the controls surrounding the sun. Then answer the following questions. Replay and review any section as needed.
   1. Photosynthesis is made up of two series of reactions. Where do they occur?
   2. Describe the point(s) in photosynthesis where light energy is absorbed. What happens to the energy once it is absorbed?
   3. What happens to the water molecule at photosystem II (PSII)?
   4. List the products that result when water is split.
   5. What happens to the electrons that result from the splitting of water?
   6. Describe the reaction that occurs when the electrons "travel" down to photosystem I (PSI). Identify any reactant(s) and product(s) of the reaction that you observe.
   7. How does light affect the behavior of the electrons when they reach PSI?
   8. After the electrons pass through PSI, they take part in a chemical reaction. The electrons are added to a reactant as one of the products of the thylakoid reactions is formed. What is the name of the reactant? What product is formed?
   9. On your Data Sheet, write a chemical reaction for the thylakoids in Table 1. List all of the reactants on the left side of the arrow and all of the products on the right side.
   10. Is light energy absorbed directly by the reactions in the stroma?
   11. List all the reactants in the stromal reactions.
   12. How many CO2 molecules are incorporated per cycle?
   13. Are the products from thylakoid reactions (questions 6 and 9) used as reactants in the stromal reactions?
   14. How many cycles does it take to produce one molecule of glucose?
   15. List the products from the stromal reactions. What happens to these products?
   16. Write a chemical reaction for the stroma in Table 1. List all of the reactants on the left side of the arrow and all of the products on the right side.

Part II: Observations of Photosynthesis

1. Click the Experiment tab. Observe the BioScope.
   1. Is the light on or off?
   2. Describe what is happening in the thylakoid. Explain your observation.
   3. Describe what is happening in the stroma. Explain your observation.
2. Click the Daytime button to turn on the light. Focus your attention on the light 'waves' in the thylakoids.
   1. Describe the nature of the light being given off by the sun.
   2. Describe the color(s) of the light being given off by the sun.
3. Click the Nighttime button to turn off the light.
4. Focus your attention on the thylakoids. Click the Daytime button to turn on the light.
   1. Does the process begin as soon as the light is absorbed, or is there a further delay before the reactions start?
5. Click the Nighttime button to turn off the light.
   1. Observe the thylakoid reactions when the light is turned off. Do the reactions stop or do they continue? If they stop, do they stop immediately or do they continue until the energy previously absorbed from light is used up? Explain.
6. Focus your attention on the stroma. Click the Daytime button to turn on the light.
   1. Do the reactions begin as soon as the light is turned on or is there a delay before the reactions start?
   2. What triggers the reactions in the stroma? Is it light or some other factor(s)?
7. Click the Nighttime button to turn off the light.
   1. What happens to the stromal reactions when the light is turned off? Does this happen immediately or is there a delay between when the light is turned off and when the effect occurs? What factor(s) (light, specific molecules) are involved in this response?
8. Consider the two processes, the thylakoid reactions and the stromal reactions, together. Click the Daytime button to turn on the light.
   1. How are the two processes linked?
   2. Record the value for Photosynthetic Efficiency in Table 2.
9. Click the Nighttime button to turn off the light.
   1. Record the value for Photosynthetic Efficiency in Table 2.

Part III: Environmental Effects on Photosynthesis

1. Make sure that the Experiment window is selected. Click the Daytime button to turn on the light. Click Specific Wavelength. Make sure that the wavelength range of 400-430 nm is chosen.
   1. Record the light color(s) in the second column of Table 2.
   2. Is the light absorbed? Answer "yes" or "no" in the third column of the table
   3. Observe the thylakoid and stromal reactions and record any effects of the reduced light in the fourth column of Table 2.
   4. Finally, record the photosynthetic efficiency in the last column of the table.
2. Select the next wavelength range (430-460 nm) and make the same observations as you did to complete questions 30-33.
   1. Record your data in Table 2.
3. Repeat these observations for each of the specific wavelength ranges.
   1. Record your data in Table 2.
4. Click the White light button. Examine the CO2 and O2 controls in the upper right corner. Make sure that high CO2 and low O2 are selected
   1. Note your observations for the high CO2 and low O2 ratio in Table 3 and record the value for Photosynthetic Efficiency in the last column of the table.
5. Change the CO2 from high to low by clicking the CO2 Low button.
   1. Observe the thylakoid and stromal reactions and record any effects of the altered CO2:O2 ratio in Table 3.
   2. Observe the CO2 cycle counter on the right side of the BioScope. Does the counter advance when O2 is used in place of CO2?
   3. Record the value for Photosynthetic Efficiency in Table 3.
6. Change the O2 from low to high by clicking the O2 High button.
   1. Observe the thylakoid and stromal reactions and record any effects of the altered CO2:O2 ratio in Table 3.
   2. Record the value for Photosynthetic Efficiency in Table 3.
7. Change the CO2 from low to high by clicking the CO2 High button.
   1. Observe the thylakoid and stromal reactions and record any effects of the altered CO2:O2 ratio in Table 3.
   2. Record the value for Photosynthetic Efficiency in Table 3.

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